

REMARKS

Claims 39-44 are pending in this application. Claim 42 has been amended. A Notice of Allowance was mailed in the present application on December 26, 2007 and Applicants paid the issue. However, in the April 25, 2008 Office Action, the Examiner withdrew the application from issuance and rejected Claims 39-40 under 35 U.S.C. 102(b) as being anticipated by U.S. Patent No. 6,383,310 to Otsuka et al. (Otsuka), as evidenced by U.S. Patent No. 4,919,711 to Banyai et al. (Banyai). Further, the Examiner rejected Claims 41-43 under 35 U.S.C. 103(a) as being unpatentable over Otsuka and Claim 44 under 35 U.S.C. 103(a) as being unpatentable over the combination of Otsuka and the Applicant's Admitted Prior Art. Reconsideration of the application and allowance of claims 39-44 are respectfully requested.

A. Independent Claim 39

Independent Claim 39 requires (in part): “[a] method for controlling the castability of liquid steel, the method comprising:

establishing a first range of relative concentration limits for at least two elements of a melt such that a subsequent casting of the melt will exhibit acceptable mechanical properties;

establishing a second range of relative concentration limits for the at least two elements of the melt as a subset of the first range of relative concentration limits such that the melt is castable...”

The Examiner contends at pages 2-3 of the April 25, 2008 Office Action that Otsuka teaches “establishing a second range of relative concentration limits for the at least two elements of the melt as a subset of the first range of relative concentration limits such that the melt is castable” at col. 8, lines 23-28 of Otsuka. Specifically, the Examiner contends:

At col. 8, lines 23-28, Otsuka et al. discloses that when the weight ratio of Cr/Ni exceeds 1.5, secondary Cr carbides are excessively precipitated together with brittle precipitates such as an alpha-phase, resulting in extreme brittleness. This determination of Otsuka et al. constitutes “establishing a second range of relative concentration limits for at least two elements of the melt as a subset of the first range of relative concentrations limits such that the melt is castable.

Further, according to the Examiner at page 3 of the April 25, 2008 Office Action, “it is known that castability and brittleness go hand in hand.” To support this assertion, the Examiner points to col. 4, lines 63-68 of Banyai, which states “[t]his phosphorous is found in the resultant steel. It is known to have adverse effects on the physical properties of the steel such as reduced

castability, i.e. increased brittleness and reduced strength.” Applicants respectfully submit the Examiner’s position is incorrect. Brittleness and castability do not go hand in hand, thus Otsuka’s teaching of establishing a range for two elements of a melt to avoid the production of a brittle product does not constitute “establishing a second range of relative concentration limits for the at least two elements of the melt as a subset of the first range of relative concentration limits such that the melt is castable” as claimed. For this reason, Applicants submit that Claim 39 is not anticipated by Otsuka.

As set forth on page 10 of the attached publication (Makhlouf et al, Casting Characteristics of Aluminum Die Casting Alloys, Final Report prepared for the US Department of Energy, Office of Industrial Technologies (February 5, 2002)):

...‘castability’ of an alloy is taken to refer to those properties of the alloy that characterize its behavior in the casting process. Being cast with desired quality, an alloy must have various characteristics including ease of feeding, fluidity (flowability), low hot tearing tendency, low porosity caused by gas dissolution, no macrosegregation, no tendency to solder to the die, and no tendency to form sludge. In some instances, the alloy’s behavior during manufacturing processes subsequent to casting is also considered as a casting characteristic, e.g., the alloys ease of machining, welding, and anodization.

As seen, no mention of brittleness is made with regard to the characteristics required for desirable castability. In addition, one skilled in the art would readily appreciate that brittleness is not a property that would affect an alloy’s behavior in the casting process because brittleness is a mechanical property of the alloy that may be examined after casting has taken place. Moreover, contrary to the Examiner’s position, Banyai does not teach that castability and brittleness go hand in hand. Instead, Banyai states through its disclosure that “phosphorous...is known to have adverse effects on the physical properties of the steel such as reduced castability, i.e. increased brittleness and reduced strength.” See col. 4, lines 63-68 of Banyai. One of ordinary skill in the art, upon a reading of Banyai, would thus understand that Banyai refers to castability and brittleness as separate and distinct physical properties. Thus, the Examiner is incorrect to assert that Otsuka’s teaching of establishing a range that avoids producing a brittle product constitutes “establishing a second range of relative concentration limits for the at least two elements of the melt as a subset of the first range of relative concentration limits such that the melt is castable” as claimed. In view of the above, Applicants submit that the prior art does not support the rejection of Claim 39 under 35 U.S.C. 102(b) and must be withdrawn.

In addition, Applicants submit that Otsuka fails to expressly or inherently describe “establishing a second range of relative concentration limits for the at least two elements of the melt as a subset of the first range of relative concentration limits such that the melt is castable...” because the range that the Examiner considers as a second range is not “a subset of the first range of relative concentration limits” as claimed. In particular, Otsuka discloses that “the austenitic cast steel exhibits higher oxidation resistance and high-temperature strength. Such effects, however, are saturated when the weight ratio of Cr/Ni reaches 1.0.” See col. 8, lines 20-23 of Otsuka. The Examiner contends that the first range is thus defined as a ratio of greater than 1.0. See page 2 of the April 25, 2008 Office Action. Applicants respectfully disagree with the Examiner’s characterization of Otsuka.

Clearly, Otsuka discloses that there is no benefit of providing Cr/Ni in a ratio of greater than 1.0 because the higher oxidation resistance and high-temperature strength effects are saturated when the weight ration of greater than 1.0. Thus, Applicants submit the proper interpretation of Otsuka is that the first range is “up to 1.0,” not “greater than 1.0” as contended by the Examiner. As a result, *assuming arguendo* for the purpose of this argument only, that Otsuka established a second range of Cr to No of 1.0-1.5 for Cr/Ni as contended by the Examiner on page 3 of the April 25, 2008 Office Action, Otsuka does not disclose “establishing a second range of relative concentration limits for the at least two elements of the melt as a subset of the first range of relative concentration limits such that the melt is castable...” because the first range of “up to 1.0” is not a subset of the second range 1.0-1.5 in Otsuka. For this reason further, Applicants submit the prior art does not support the rejection of Claim 39 under 35 U.S.C. 102(b) and must be withdrawn.

B. Dependent Claims

Claims 40-44 are dependent on Claim 39 and thus incorporate the limitations of Claim 39. Therefore, for the reasons set forth above with respect to Claim 39, Applicants submit dependent claims 40-44 are in condition for allowance.

i. Dependent Claim 42

Applicants have amended dependent claim 42 to recite that the method of claim 39 further comprises “establishing the second range of relative concentration limits between each pair of alloying elements in the group comprising Si/O₂, S/O₂, Si/ O₂, Al/O₂, S/C, and N/C.”

Importantly, as set forth in paragraph [0017] of the present published application, these five pairs "have a serious effect on the castability [of an alloy]. Even if only these five pairs are taken into account with a view to achieving an efficient method it is still possible to achieve excellent results as regards predicting and controlling the castability." Nothing in Otsuka recognizes the criticality of the claimed five pairs of alloying elements in amended claim 42 (Si/O₂, S/O₂, Si/ O₂, Al/O₂, S/C, and N/C). In addition, as admitted by the Examiner on page 4 of the April 25, 2008 Office Action, Otsuka establishes preferred ranges for C, Si, Mn, and S. Thus, Otsuka fails to teach or suggest "establishing the second range of relative concentration limits between each pair of alloying elements in the group comprising Si/O₂, S/O₂, Si/ O₂, Al/O₂, S/C, and N/C." In view of the above, Applicants submit amended dependent Claim 42 provides further reasons for allowance.

C. Conclusion:

Reconsideration of the application and allowance of claims 39-44 are respectfully requested. The commissioner is hereby authorized to charge any appropriate fees due in connection with this paper, or credit any overpayments to Deposit Account No. 19-2179.

Respectfully submitted,

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(one attachment)